CORNELL 4-H CLUB BULLETIN 39

Log Scaling and Timber Estimating

JAMES D. POND *and* FRED E. WINCH, JR.

LOG SCALING AND TIMBER ESTIMATING PROJECT

Purposes

1. To teach 4-H Club members:

   How to find the board-foot contents of logs (scaling).

   How to lay out a square or rectangular area in the woodlot.

   How to find the board foot content of standing trees (timber estimating).

2. To assist these young folks in recognizing the value of timber crops.

Requirements

1. In the woodlot:

   Scale 10 logs at least two of which have some defect or are crooked.

   Select an area in the woodlot containing at least 50 fairly straight, sound trees, most of which are 10 inches or more in diameter, and within this area lay out a 1-acre square or rectangular plot.

   Measure and tally in the plot the diameters of all merchantable trees (8 inches and more) and the heights of enough trees to determine the various height classes.

2. In the home or shop:

   Make the following equipment:
   - Tally sheets for scaling and estimating
   - Tally board
   - Height measurer (hypsometer)
   - Diameter tape
   - Lining-out instrument

   Record results of scaling and estimating in the project record sheet:

   Of the logs scaled by each of the following log rules: Scribner, International, and Doyle.

   Of all trees measured, and, by referring to the tables in this bulletin, change measurements to board-foot volumes.

   Send the project record sheet, properly filled out, to the county club agent by October 1.

Enrollment

Club members register for their projects at the beginning of the club year in October or November. Late fall and early winter are the best times in which to carry out this project, for then the leaves have fallen from the trees and it is easier than at other seasons to lay out the plot and to obtain tree heights. The measurements should be taken before deep snow and cold weather appear. The board-foot volumes may be figured indoors.

The project should be completed before the following October if the club member wishes to obtain his achievement pin.

Log Scaling and Timber Estimating

James D. Pond[1] and Fred E. Winch, Jr.

There are 3,300,000 acres in the farm woodlots of New York State. This means that on the average farm with woods in New York State, 46 acres are in woods.

Without question, some of the very best timber yet standing in the State of New York is in those 3,300,000 acres of farm woodlots. It is extremely important, therefore, that you, the farm youth of today, who are to be the land owners and farmers of tomorrow should have an understanding of forestry principles as they apply to the farm woodlot. Club members learn to identify and recognize all the common trees in their woodlots; they learn how to use the axe in improving growing conditions in the woodlot, and in providing some usable product such as fuel wood at the same time. It is important in this forestry project to give some attention to the mature crop that is ready for harvesting.

Timber as a farm crop is a little different from most of the other crops raised for sale on the farm in that it is not in shape to be sold direct to the consumer but has to go through a manufacturing process first. Apples, potatoes, corn, milk, and eggs are sold direct and in shape for use in terms of units of weight or quantity. It is true that wheat, another farm staple, has to be manufactured into flour or cereal before being consumed, but the terms of sale are in the same familiar units as other crops—pounds and bushels. No one would expect you to sell your wheat crop on the basis of the number of pounds of flour or the number of loaves of bread it would make to the acre. And yet that is precisely what is done with timber. The unit of sale is the manufactured unit, the board foot, and that has to be translated into the growing unit, the log. It is no wonder then that some manufacturers have bought logs and trees cheaply, by taking advantage of the farmer's lack of knowledge of the board-foot contents of his logs, his trees, and his woodlot.

It is the purpose of this project to teach you how to estimate the board-foot contents of logs, of standing trees, of whole woodlots. Then if your Dad wants to build a garage or repair a barn, you can quickly tell him how

[1] For much of this material, taken from the previous bulletin under this title, the writers wish to give full credit to its original authors, J. A. Cope and J. E. Davis.

many trees of a given size he will need to cut down to give the required lumber. Or, if someone offers to buy a part of the woodlot, the trees can be estimated quickly to ascertain whether the offered price is sufficient.

PART I

BOARD-FOOT CONTENTS OF A LOG

Units of measure

SEVERAL units of measure are used in the sale of forest products. Fuel wood and pulpwood are sold by the cord, with considerable variation in the length of the sticks that go to make up the cord. Poles, piling, and props are sold by the lineal foot, while posts are sold by the piece with certain definite specifications as to length and diameter. The unit in which you are chiefly interested, however, is the *board-foot*, the unit in general use to express the amount of sawed lumber in a log.

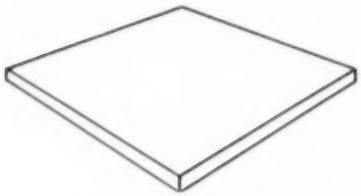


FIGURE 1. A BOARD FOOT

A board foot is a piece of lumber 1 foot long, 1 foot wide, and 1 inch thick.

When speaking of the output of a mill or of the contents of standing trees, the unit is multiplied by one thousand, and it is said that a woodlot contains so many *thousand board feet*. This is abbreviated to the letters M.B.F., since *M* is the letter representing one thousand in the Roman numbering system.

To determine the number of board feet in a piece of sawed lumber of any length, width, and thickness, multiply its length in feet by its width in inches by its thickness in inches and divide by 12. For example: A timber 16 feet long, 8 inches wide, by 6 inches thick, contains 64 board feet.

$$\frac{16\times 8\times 6}{12}=64$$

If the board is in even fractions of a foot in width, multiply its length in feet by its width in feet, by its thickness in inches, and read the answer direct without dividing by twelve. A plank 14 inches long, 1½ feet wide, and 2 inches thick contains 42 board feet.

$$14\times 1\tfrac{1}{2}\times 2=42$$

Log scaling

It is not easy to obtain the board-foot contents of a log. To make this work simpler and easier, certain tables, known as *log rules,* have been made to give the board-foot contents of logs of different diameters and lengths. The process of obtaining the board-foot contents of a log by one of these rules is known as *scaling.* Three of the better known log rules in use in New York State are:

Doyle, an old log rule, came into use when most of the logs were large, taken from virgin timber. It gives too small a measure for small logs, but is satisfactory for logs 20 inches and more in diameter.

Scribner, a fairer rule than the Doyle to both buyer and seller, although it gives a slight under-run for small logs and a small over-run for large logs.

International, a more recent rule used largely in New England, is accurate for softwoods such as pine and hemlock, but gives too large a measure on the smaller hardwood logs.

To obtain the number of board feet in a log, you need to know (1) the diameter, average, inside the bark; (2) the length to the nearest even foot; (3) the size of any defect; (4) the volume from the log rule.

Scale the logs and compute the volumes by each of the three log rules listed. Only one set of measurements, of course, is necessary, but post the three different volumes in the yellow record sheet inserted in the middle of this bulletin.

TABLE 1. SCRIBNER LOG RULE

(Contents in board feet of logs in seasoned 1-inch square-edged boards; ¼-inch saw-kerf*)

Top diameter inside bark (inches)	Log lengths (feet)					Top diameter inside bark (inches)	Log lengths (feet)				
	8	10	12	14	16		8	10	12	14	16
6	6	10	12	14	18	21	152	190	228	266	304
7	12	16	18	24	28	22	167	209	251	292	334
8	15	20	24	28	32	23	188	235	283	330	377
9	20	25	30	35	40	24	202	252	303	353	404
10	24	31	40	45	50	25	229	287	344	401	459
11	32	40	50	55	65	26	250	313	375	439	500
12	40	49	59	69	79	27	274	343	411	479	548
13	48	61	73	85	97	28	291	363	436	509	582
14	57	71	86	100	114	29	305	381	450	533	609
15	71	88	107	125	142	30	328	410	493	575	657
16	79	99	119	139	159	31	355	444	532	622	710
17	93	115	139	162	185	32	368	460	552	644	736
18	106	133	160	187	213	33	392	490	588	686	784
19	120	150	180	210	240	34	400	500	600	700	800
20	140	175	210	245	280	35	435	547	657	766	876

* Saw-kerf is the amount of wood removed by the saw in sawdust.

TABLE 2. International Log Rule

(Contents in board feet of logs in seasoned 1-inch square-edged boards; ¼-inch saw-kerf*)

Top diameter inside bark (inches)	Log lengths (feet)					Top diameter inside bark (inches)	Log lengths (feet)				
	8	10	12	14	16		8	10	12	14	16
6	9	10	13	15	20	21	155	195	235	280	320
7	13	15	20	25	30	22	170	215	260	305	355
8	18	22	25	35	40	23	185	235	285	335	390
9	22	30	35	45	50	24	205	255	310	370	425
10	30	35	35	55	60	25	220	280	340	400	460
11	35	45	55	70	80	26	240	305	370	435	500
12	45	55	70	85	95	27	260	330	400	470	540
13	55	70	85	100	115	28	280	355	430	510	585
14	65	80	100	115	135	29	350	385	465	545	630
15	75	95	115	135	160	30	325	410	495	585	675
16	85	110	130	155	180	31	350	440	530	....	....
17	95	125	150	180	205	32	375	470	570	....	....
18	110	140	170	200	230	33	400	500	605	....	....
19	125	155	190	225	260	34	425	535	645	....	....
20	135	175	210	250	290	35	450	565	685	....	....

* Adapted directly from the Federal land-bank cruising stick. These results have been rounded off to the nearest 5 feet.

TABLE 3. Doyle Log Rule

(Contents in board feet of logs in seasoned 1-inch square-edged boards; ¼-inch saw-kerf*)

Top diameter inside bark (inches)	Log lengths (feet)					Top diameter inside bark (inches)	Log lengths (feet)				
	8	10	12	14	16		8	10	12	14	16
6	2.0	2.5	3.0	3.5	4	21	144	181	217	253	289
7	4.5	5.6	6.8	7.9	9	22	162	202	243	283	324
8	8	10	12	14	16	23	180	226	271	316	361
9	12	16	19	22	25	24	200	250	300	350	400
10	18	22	27	31	36	25	220	276	331	386	441
11	24	31	37	43	49	26	242	302	363	423	484
12	32	40	48	56	64	27	264	331	397	463	529
13	40	51	61	71	81	28	288	360	432	504	576
14	50	62	75	87	100	29	312	391	469	547	625
15	60	76	91	106	121	30	338	442	507	591	676
16	72	90	108	126	144	31	364	456	547	638	729
17	84	106	127	148	169	32	392	490	588	686	784
18	98	122	147	171	196	33	420	526	631	736	841
19	112	141	169	197	225	34	450	562	675	787	900
20	128	160	192	224	256	35	480	601	721	841	961

Measuring diameter

In the log rules (tables 1, 2, and 3), the left-hand column is headed *Top Diameter Inside Bark*. This calls attention to an important point in the use of most log rules. Measure the diameter of the log at the top, or small end, inside the bark. A minute's thought will easily show why this must be so. If board-foot contents were figured on the basis of measurement of the large-end of the log, much too large a result would be shown, for the saw starting in at the large end would soon run out of the cut owing to the taper of the log.

FIGURE 2. DIAMETER INSIDE BARK, 26 INCHES

Often the log scaled is not perfectly round, such as many basswood logs. In that case, take neither the largest nor the smallest diameter but an average of the two as the actual diameter. For example, a log measuring 12¼ inches on the smallest top diameter and 14½ on the largest top diameter would average 13⅜ inches, or a 13-inch log. The rule is to average to the nearest inch, dropping halves; for example, a log averaging 15½ inches is scaled as 15 inches, while one measuring 16¼ is a 17-inch log. Diameter inside the bark is usually shortened to d.i.b.

Measuring length

In the log-rule tables, the log lengths are given in multiples of 2 feet, starting at 8 and going to 16 feet. This covers the range of log lengths used in common practice. Odd lengths (except in the 13-foot length used in the eastern Adirondacks with the Standard log rule) are not recognized; an 11-foot log is classed as a 10-foot log. You cannot stretch a log in length. Thus a log 15 feet 9 inches long is still classed as a 14-foot log. The customary practice, when bucking the logs, is to add a trimming allowance of

3 or 4 inches. This allows for cutting off the ends of boards, after they are sawed, so that there will be clean ends on the boards which will measure exactly 10, 12, or 16 feet in length, as the case may be. Theoretically, a log measuring 12 feet, and not an inch more, should be classed as a 10-foot log, because there will be a loss of 2 feet in trimming to the next shorter even-foot length.

Grading logs

Many mills and buyers are now buying logs by grade, instead of by "log run." This is a better practice, because better prices are obtained for good logs. Very poor logs should be used for other products, such as fuelwood, mine props, or fence posts, and kept at home. New York State woodlots lack quality, rather than quantity, in logs. Usually there are two, but sometimes four, grades of logs:

Grade I: Logs that are 12 inches and more in diameter inside the bark, are straight, sound, and free of knots. (One knot not more than 2 inches in diameter near the top-end is sometimes allowed.) A certain proportion, usually about one-half, of the logs must be 14 and 16 feet in length.

Grade II: Logs between 10 and 12 inches (d.i.b.), or that are somewhat crooked, unsound, and that do not show more than five defects such as large knots, rotten spots, frost cracks, splits. At least one-fourth of the logs must be 14 and 16 feet long.

Grade III: Logs below the specifications of those in grades I and II.

Culls: Logs that will lose more than 50 per cent of their volume because of rot, splits, or cracks, are classed as "culls," and will not be accepted by the mills. Make such logs into firewood or saw them into lumber for use on the farm.

Defects and crook

Scaling straight, clear, sound logs is fairly easy. But judging crook and amounts to take out for defects, such as cracks, rotten spots, "shake," and splits, is more difficult.

For normal sweep (bend in a log) and crook, there is no loss. Grade I logs are allowed to have a sweep of 1 inch in 8 feet, while grade II logs can vary 2 inches in 8 feet. A 12-foot grade II log can thus vary 3 inches without loss in the scale. The method of determining the amount of crook in a log is shown in figure 3.

To measure a crooked log, from the side of the top, or small end, draw a line along and parallel to the side of the log as far as it runs straight and then extend it to the butt (line *AC*, figure 3). The length of the log is measured from the top to the point *B*, where the line starts to cross the log.

It is estimated that *half* of the *remainder* of the log will be waste. For instance, if the log is 16 feet long, and the line crosses at 12 feet, then half of the remainder (4 feet) must be dropped (2 feet), so the log is scaled as a 14-foot log (12 feet plus 2 feet) as shown below.

Another method is used to determine the loss for defects. Rotten spots may not show on both ends of the log, so the extent of the rot must then be estimated, usually beyond any open hole or unsound knot on the side of the log. "Shake" is common in hemlock when the annual rings separate easily. Losses from cracks and splits extending more than 2 inches inside the bark must be measured and deducted from the log scale.

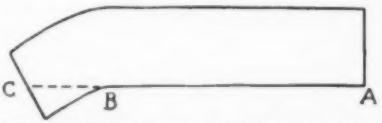


FIGURE 3. MEASURING CROOK IN A LOG

For such defects, the usual practice is to add 1 inch to the width and to the thickness of the visible defect, multiply by the estimated or measured length in feet, and convert the result to board feet as shown on page 4. For example, a log showing a rotten spot measuring 3 inches by 5 inches is to be scaled. The rot is estimated to run 8 feet up the log. Adding 1 inch to each measurement on the end of the log makes them, respectively, 4 inches and 6 inches. Therefore the loss is: $\frac{4 \times 6 \times 8}{12} = 16$ board feet to be taken from the total scale of the log.

Enter the sizes of any defect and the lengths of crook measured on at least *two* logs in the record sheet as part of your required work for this project. The volumes are results after defects have been subtracted.

Tools and equipment for log scaling

The following items are necessary before going into the field to scale logs: (1) tally sheet, (2) tally board, (3) pencil, (4) yardstick, (5) black lumber crayon or chalk.

1. Tally sheet. This is a plain sheet of paper ruled so as to record the full measurements of species, diameter, length, and board-foot contents of the ten logs to be scaled. These complete records are to be transferred to the project-record sheet. Therefore, the form shown on the project-record sheet in the center of the bulletin should be used as a guide. A sheet of paper 8 inches by 10 inches is ample for this purpose.

2. Tally board. The tally board is simply a smooth piece of board about ¼ to ½ inch thick and of the same dimensions or a little larger than the tally sheet. The tally sheet may be held in place on the tally board by thumb tacks or elastic bands, one at the top and one at the bottom.

Actual log scaling[2]

Logs may be scaled easily when they are stacked in a single "deck" or layer on the skidway so they can be rolled over to find defects. Logs may best be scaled, however, as they are hauled onto the skidway, for then they need not be rehandled.

The method easiest to follow is:

1. On the first log, measure the diameters roughly at both ends to find the small end.

2. Obtain the average diameter inside the bark at the small end and record this to the nearest inch.

3. Measure any defects or crooks, and record sizes to next larger inch or foot.

4. With the lumber crayon, mark a large number on the small end of the log, and also in a circle mark the grade as I, II, or III.

5. On the tally sheet (center of bulletin) opposite log number *1* enter the name of the species in the space provided, and also the grade.

6. Slide the yardstick along the log, end to end, to determine the log length to the even foot actually possible to cut, and record the length in the proper column.

7. Repeat this operation for the other nine logs, numbering them one after the other with crayon or chalk.

8. At home, refer to pages 5 and 6 in this bulletin for the volumes of the logs measured. Post these volumes, for each of the three log rules, in the proper columns in the record sheet. Also, copy additional information on species, diameter, and length, from the tally sheet to the record sheet.

9. When the volumes have been posted in the record sheet, add each column. Which log rule gives the greatest number of board feet? Which log rule is most common in your community? By which rule would you sell?

This completes the first part of the project.

PART II

BOARD-FOOT CONTENTS OF A STANDING TREE

THE term *scaling* applies to finding the board-foot contents of logs. Similarly, the term *timber estimating* applies to finding the board-foot contents of standing trees.

There are many ways of estimating the board-foot contents of standing trees. Experienced woodsmen can do it by merely glancing at the tree and

[2] A scale stick, together with a timber-estimating stick, based on the International log rule, may be obtained from the Federal Land Bank, Springfield, Massachusetts.

then judging from their previous experience how many board feet it will saw out. Others estimate the number of 16-foot logs in the tree, guess the top diameter of the average log, scale it as a log by the International log rule or any other rule they happen to know and the tabulated amounts of which rule are handy for reference, and then multiply this figure by the number of logs in the tree. For the inexperienced person, however, it is important to take some fairly accurate measurements of the tree to arrive at an estimate of the board-foot contents.

Trees grow in height and in diameter; therefore, some methods of measuring both height and diameter have been devised.

Measuring height

The height of a tree may be obtained in two ways. The use of a straight stick and pacing the distance is less accurate than the other method of using a height-measurer (hypsometer) at a known distance from the tree.

Stick method

The straight-stick method is the handiest, for it can be used in the woods without any other equipment. The stick is about 4 feet long. The principle of similar triangles is applied, plus the knowledge of the length of your pace. If the stick is weighted at the lower end, it is still better. The method is as follows:

1. Walk away from the tree about 50 or 60 feet.
2. Then standing at point *A* (figure 4) grasp the stick near its lower end *(c)* so that, held at arm's length, to top of the stick *(b)* touches your eye. Thus the distance *b-c* equals *A-c*.
3. While the arm is still extended full length, tip the stick straight up (vertically) without moving the grip. (The weighted lower end makes it easier to hold the stick straight.)
4. Then walk forward or back until the sight over the top of the stick *(b)* (figure 4) just catches the top of the tree to be measured, and the sight over the fist *(c)* finds the stump of the tree. The arm must be kept extended and level.
5. Since the distance from the hand to the top of the stick is equal to the distance from the hand to the eye, then the height of the tree *(BC)* is equal to the distance from the measurer at *A* to the tree at *C*. This distance is paced.
6. Pacing is an easy way to measuring distance along the ground. A pace is two steps, and commonly called *6 feet*. However, the pace will usually vary with persons of different heights.

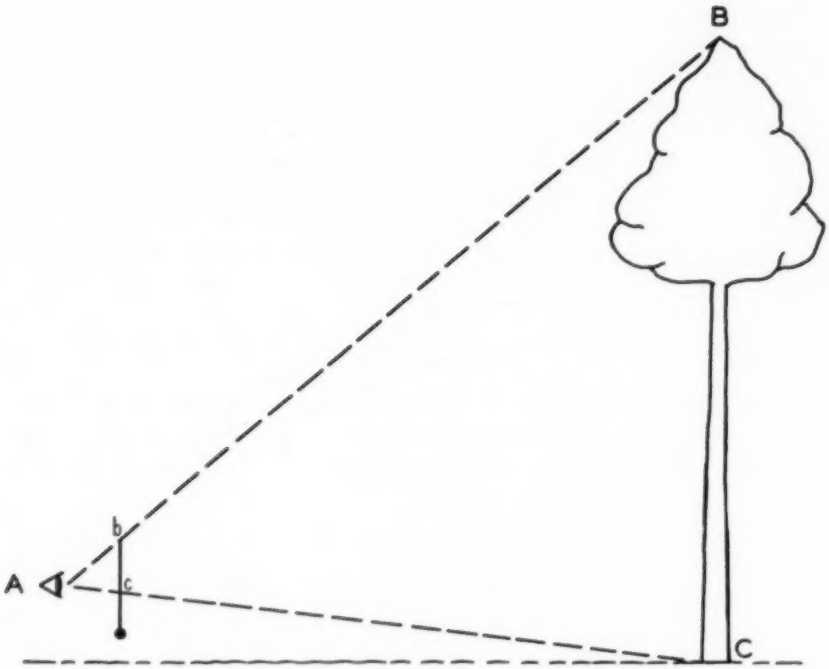


FIGURE 4. STICK METHOD OF MEASURING HEIGHTS

Measure a distance of 100 feet on a fairly level stretch of ground, then pace the length *three* times, and count the paces (not steps). If 60 paces are tallied in 300 feet, then each pace is 5 feet, an easy number to use and remember. If however, the total should be 55 paces, then the length of the pace is 300 divided by 55 or 5.45 feet, or 5 feet 5½ inches. The pace should not be stretched, for you become tired if you reach out during the measurement of long distances.

Hypsometer method

The stick method of measuring heights, while handy, is not accurate within 5 feet. To obtain heights more closely, a hypsometer is used. Part of this project is to make this simple height measurer.

A hypsometer may be made at home. The materials and directions are given in the following paragraphs.

Materials:

One piece of board 7 by 9 by ½ (or ¾) inches

Two brads or small nails

One ½-inch wood screw
One piece of heavy wire
One piece of wood 6 by 1 by ½ inches
Two or three 1¼-inch wood screws

Directions:

1. Plane the board smooth on all sides.
2. Refer to figure 5 for the letters indicated in the following paragraphs.
3. Draw in pencil line *AB* ⅜ of an inch from, and parallel to, the lower edge of the board.
4. Draw in pencil line *CD* 2 inches from the left edge of the board and at right angles to line *AB*.
5. To locate point *E*, make a mark 6¼ inches up from point *D*. *D* is 2 inches from the left side of the board on *AB*.)
6. Mark point *F* 3⅛ inches from point *D* on line *CD*.

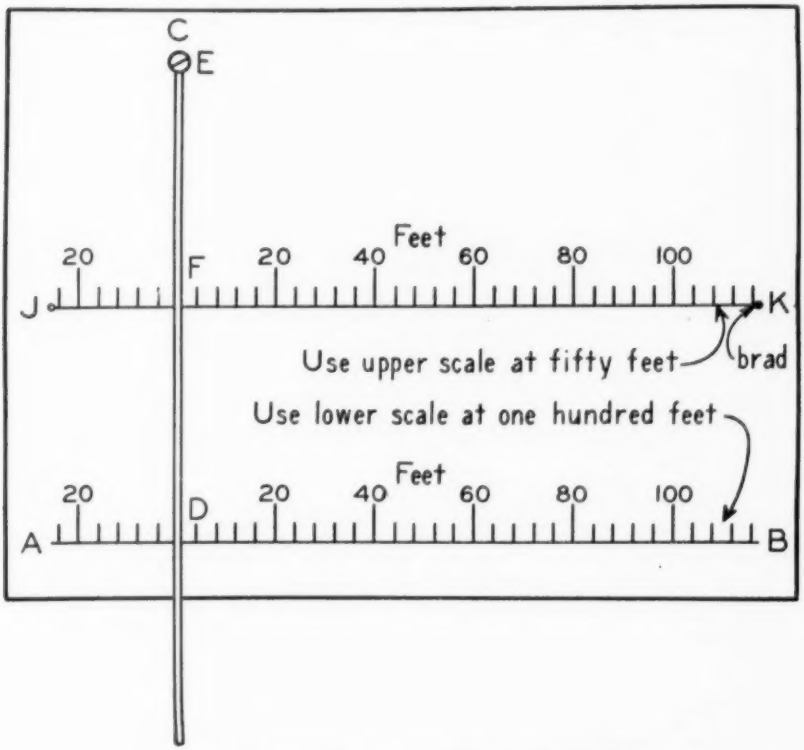
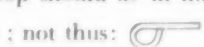


FIGURE 5. A DIAGRAM OF A HOMEMADE HYPSOMETER

7. Draw line *JK* through point *F* and parallel to line *AB*.
8. Starting at point *D*, lay off ¼-inch spaces on line *AB* in both directions, marking point *D* as zero.
9. On line *JK*, lay off ¼-inch spaces marking point *F* as zero.
10. Counting from *D* and *F* (zero), make every fifth line longer. Since every ¼ inch on lines *AB* and *JK* equals 4 feet (of height), label these longer marks *20, 40, 60,* and so on. The marks and lines should be in pencil because ink spreads too much in the wood fibres.
11. Take one of the brads or small nails and drive it in carefully 1 inch from the left side of the board and on line *JK*, until the point comes through the board.
12. Draw out the brads and drive it in the same hole *from the back* of the board, until the point sticks out about ¼ inch on the face of the board. If part of the brad or nail still sticks out of the back, it should be cut off with pliers.
13. In the same way insert a brad at point *K*, about 1 inch from the right side of the board. These brads are the sights, and it is important they be set straight and true.
14. Bend one end of the piece of heavy wire (telephone wire or heavier) into a loop with an inside diameter of about ⅛ of an inch. The center of the loop should be in line with the straight part of the wire thus:  ; not thus: 
15. Fasten the loop loosely with the ½-inch screw at point *E*. The loop should be large enough to fit easily over the shank of the screw, but small enough not to slip off the head.
16. To the back of the board fasten, with the long screws, the strip of wood to serve as a handle.
17. Erase the letters *D, E, F, G,* and so on, leaving only the line marks and figures.
18. Letter under line *JK* this title: "Use at 50 feet"; and under line *AB*, "Use at 100 feet."
19. Mark a plus sign (+) to the right of line *CD* and a minus sign (—) to the left of the line *CD*.
20. Give the whole hypsometer two coats of *white* shellac or varnish.

Using the hypsometer

To measure the height of a tree, pace or measure 100 feet (or 50 feet) from its base; hold the instrument in the right hand in such a way that the pendulum swings freely but very near the board. Sight along the brads (which are used like the sights of a gun) to the top of the tree and hold

the hypsometer steady until the pendulum stops swinging. Then with the left hand press the pendulum against the board without giving it a chance to move. Lower the board and read the number of feet in height on the lower, or 100-foot, scale. If you are standing 50 feet from the tree, read the upper scale. If the wire crosses the scale at a point two marks beyond the 60-foot line, then the reading is 68 feet. A club member sighting on the top of a tree with his hypsometer is shown in figure 6.

FIGURE 6. MEASURING THE HEIGHT OF A TREE WITH A HOMEMADE HYPSOMETER

Next, sight in the same manner at the base of the tree and take another reading. And here comes slightly difficult arithmetic. If the pendulum falls to the left of the line, then add this reading to the reading taken on the top of the tree. For this "minus" reading shows that the eye is so many feet above the stump. If, however, the reading is "plus," then *subtract* it from the first reading. A "plus" reading shows the stump is above your eye level.

Example: The first reading is 68; the reading on the stump is −6; therefore, the tree's height is 68 plus 6, or 74 feet.

If the first reading were 84 feet and the second were +4, then the height would be 84−4, or 80 feet.

Cautions:

1. Make sure that brads and wire pendulum are straight.
2. Pace or measure the distance from the tree carefully.
3. In sighting on the top of the tree, make sure the topmost branch is sighted. A sight on a near side branch may make the tree appear too tall; a sight on a far-off branch will make the reading too small.
4. Watch that the pendulum does not slip before the reading is taken; take a second reading for a check.
5. To become accustomed to using the hypsometer, try it out on several trees on the lawn where there is nothing to block the view.

Height classes

Tree heights are judged by differences of 10 feet or by 10-foot height classes. The tables on pages 22 to 24 are divided into columns headed by *30, 40, 50,* and so on. It is unnecessary to figure the height nearer than in 10-foot divisions. So the total reading of the hypsometer is placed in one of these classes, or to the nearest 10 feet.

Example: A total reading of 66 feet is taken; this places the tree in the 70-foot class.

A tree measuring 83 feet tall is in the 80-foot class.

Heights of 56 to 65 fall in the 60-foot class; from 66 to 75 in the 70-foot, and so on.

Just because the classes are in 10-foot divisions does not call for careless measurements. A difference of 1 foot in a height reading may throw the tree from one class to the next. The volumes for the various classes are made from measurements of a large number of trees and averaged.

Measuring tree diameters

It is easier to measure the diameter than the height of a tree, for the diameter can be measured directly. The tables used by foresters in

timber estimating are based upon measurements taken at a point on the trunk 4½ feet from the ground. This point, known as *diameter breast high* (d.b.h.), is easy to reach and also is above the swell from the roots which is so noticeable near the ground.

On the average man, 4½ feet is just about breast high. For the 4-H members, however, who are short, the 4½-foot point will come somewhat higher than the chest. So you should find with a yardstick or tape-measure just where this height comes on your body and keep that in mind when the trees are measured.

Foresters usually use an instrument known as *calipers* with which to measure diameters. However, since this instrument is expensive to buy and difficult to make at home, it is suggested that an ordinary tape-measure be used. Instead of changing circumference to diameter each time, on this tape you can mark with red ink, or some other colored ink or thin paint, the various diameters as listed in table 4 (page 18). This is simply making a diameter tape, another instrument often used by foresters in timber estimating.

In table 4 (page 18) it will be noted that an 8-inch tree or an 8-inch diameter measures (as closely as you can read it on the tape) 2 feet 1 inch, or 25 inches. There is a "spread" between the diameters, for a tree more than 7½ inches and less than 8½ inches is still an 8-inch tree. This "spread" is indicated in the second column in table 4. For an 8-inch tree, it runs from 1 foot to 11½ inches (23½ inches) to 2 feet 2½ inches (26½ inches).

The diameter tape is made as follows:

1. Make a long mark, from one edge of the tape to the other, at 23½ inches; make another at 26½ inches.
2. In between these marks, print the figure 8.
3. Make another mark at 29¾ inches.
4. In between this mark and the one at 26½, print the figure 9.
5. Continue with the marks until the end of the tape is reached.

A 5-foot tape measure measures trees up to 20 inches in diameter. If you have a 50-foot tape, with which to measure the pacing, or the sides of the acre for timber estimating, it will serve even better. Then one side, usually blank, can be marked off with the diameters up to 36 inches.

To measure a tree, stretch the tape around the outside of the bark in an even plane (no twists or ups and downs) at 4½ feet from the ground. A reading is taken where the zero-end of the tape meets the rest of the tape in the circle. That reading will be the circumference, or, if the tape is marked as suggested, it can be the diameter, depending upon which set of figures is read.

Example: If the tape reads 3 feet 5 inches, it falls within the spread or range of 13 inches (table 4). But on the tape, already marked, the figure 13 is found: Thus the diameter of this tree is read and then set down in the tally sheet.

Trees are measured only to the nearest inch. That is why the tape is marked only with figures for every inch in diameter.

TABLE 4. Relation between Circumference and Diameter, from 8 to 36 Inches, Inclusive

Diameter (inches)	Circumference (feet)	(inches)	(fraction of inch)	Range in circumference measurements
8	2	1	..	1.11½–2.2½
9	2	4	¼	2.2½–2.5¾
10	2	7	½	2.5¾–2.9
11	2	10	½	2.9 –3.0
12	3	1	¾	3.0 –3.3¼
13	3	4	¾	3.3¼–3.6½
14	3	8	..	3.6½–3.9½
15	3	11	¼	3.9½–4.0¾
16	4	2	¼	4.0¾–4.3¾
17	4	5	½	4.3¾–4.7
18	4	8	½	4.7 –4.10
19	4	11	¾	4.10–5.1¼
20	5	2	¾	5.1¼–5.4¼
21	5	6	..	5.4¼–5.7½
22	5	9	..	5.7½–5.10½
23	6	0	¼	5.10½–6.1¾
24	6	3	½	6.1¾–6.5
25	6	6	½	6.5 –6.8
26	6	9	¾	6.8 –6.11¼
27	7	0	¾	6.11¼–7.2¼
28	7	4	..	7.2¼–7.5½
29	7	7	..	7.5½–7.8¾
30	7	10	¼	7.8¾–8.0
31	8	1	½	8.0 –8.3
32	9	4	½	8.3 –8.6¼
33	8	7	¾	8.6¼–8.9½
34	8	10	¾	8.9½–9.0½
35	9	2	..	9.0½–9.3½
36	9	5	..	9.3½–9.6½

CORNELL 4-H CLUB PROJECT RECORD 37 FEBRUARY 1957

Timber Estimating and Log Scaling

Name.....

P. O. Address.....

Township.....

School Dist. No..... Grade..... Age.....

County Leader.....

Local Leader.....

I have visited or am familiar with this project, and to the best of my knowledge the statements contained herein are correct:

Signed..... Parent or Leader

Examined by..... County Leader

A publication of the
New York State College of Agriculture,
a unit of the State University of New York,
at Cornell University

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TIMBER-ESTIMATING RECORD

Time record of work done

Making: Lining-out instrument..... Height measurer..... Tally board and sheets.....

Laying out 1-acre plot..... Measuring and tallying trees..... Working up board-foot volume .....

Total time making instruments (line 1)..... Total time on field and office work.....

Total time on project.....

COMBINED TALLY AND BOARD-FOOT VOLUME TABLE

Species

Diameter breast high																	Totals	
	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.
8.....																		
9.....																		
10.....																		
11.....																		
12.....																		
13.....																		
14.....																		
15.....																		

13																					
14																					
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21																					
22																					
23																					
24																					
25																					
26																					
27																					
28																					
29																					
30																					
Totals																					

Grand total of last column at right and of totals across the bottom should be the same.

LOG-SCALING RECORD

Log Number	Species	Top D. I. B.	Length	Grade	Net Volume			
					Scribner	Doyle	International	Size of defect
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Total volumes								

By which rule would you sell these logs?.....

Notes on woodlot

Grazed.....	Swamp.....	Slope.....	Even-aged.....
Not grazed.....	Bottomland.....	Hilltop.....	Uneven-aged.....

Check (✓) proper spaces

Photo from U. S. Forest Service

FIGURE 7. A FORESTER USING A DIAMOND TAPE TO MEASURE A WHITE PINE

Cautions:

1. Practice using the tape on some trees on the lawn when the hypsometer is tried.
2. Some trees have swellings, knots, or small branches at the breast-high point. Shift the measurement in such cases *above* the swelling.
3. Measure trees forking within 6 feet of the ground as *two* trees. They will be cut that way.
4. Be sure the tape is run straight around the tree and that it is not twisted.
5. Be careful not to read the figures upside down, such as 6 for 9, or misread them as an 8 for a 5, or a 3 for an 8. This mistake is more common than you may think.

Selecting trees

Trees to be estimated must be graded; otherwise you will make too high an estimate of the amount of lumber than can be cut in the woodlot. Judge the trees as merchantable or unmerchantable.

A merchantable broad-leaved tree is fairly straight, and has at least 17 feet (enough to cut out one 16-foot log) to the first branch that is 2 inches or more in diameter. White pine, hemlock, and spruce often have branches much closer to the ground than this limit. This means they will cut only grade II logs, but they can still be included. Trees that show signs of rot or decay, large frost cracks, open holes, forks, and big limbs near the ground are usually unmerchantable. The rule to follow is: Will the tree cut out a good 16-foot log? If so, it can usually be estimated. Poor trees should not be included in the estimate.

Finding board-foot contents

In log scaling, a *log rule* gives the contents of a log in board feet. In timber estimating, a *volume table* is used to give the contents of standing trees in board feet. This table is based on the two measurements discussed in the preceding paragraphs, that is, height and diameter. Instead of having one volume table for all kinds of trees, it is better and more accurate to have different volume tables for trees that are widely different in their form or habit of growth. In this bulletin are three such tables for this project. One is for white pine, one for hemlock, and another is a combination volume table that you can use for all of the broad-leaved trees. In tables 5, 6, and 7, you can find the board-foot contents of practically any of the native timber trees of the State.

For the spruces (white, red, and black), balsam fir, pitch pine, and white cedar, use table 6 (hemlock); for red or Norway pine, use table 5 (white pine).

Tallying field measurements

Just as a tally sheet is used for logs, a similar form is needed on which to post the diameters and heights measured in the woodlot. The tally-board can be used as in log scaling. On this is fastened a tally sheet like the one shown on page 25. Ruled paper will save work in making lines for the various diameters.

It is best to make up the tally sheet without writing in the headings until some measurements are taken in the woodlot. There is no need to put in a column for red oak if there is none to be measured. If there are no 40- or 90-foot classes for some species, there is no need of columns for those heights.

To tally the measurements, you can save a great deal of space by using a system of dots and lines. Most persons are familiar with the old system of four lines and a cross through the four to count by 5's. A system of 10's, using dots and lines, save space and is easier to read with less confusion. This system is often used in scoring dominoes. The following shows the numbers from one to ten:

Cautions: 1. In tallying, make sure the line or dot is placed in the proper column and space.
2. Use a fairly soft pencil (No. 2 or No. 3).
3. Start the dots as if at the corners of a tiny square. Then if there are more than ten trees all 12 inches in diameter and in the 50-foot class, there will be room to start another square.

All species may not have the same height class. There may be an understory of hard maple, beech, and hemlock, with an overstory of other species. Hence a 14-inch beech might be in the 50-foot class, and 14-inch white oak in the 80-foot class. It is not necessary to measure the height of every tree, for it is soon discovered that soft maples between certain limits, say 8 to 11 inches, are in the 60-foot class, and from 12 to 15 inches are in the 70-foot class.

The column headed *miscellaneous* at the extreme right of the tally sheet is for inferior trees of which there are not enough to make a separate column. In it you can put such trees as butternut, ironwood, and shadbush, that are of little value except for fuel wood. The tally sheet as made up allows for tallying five different species as well as one column for miscellaneous species. If there are more than five species of valuable timber trees in the area being estimated, you will need another tally sheet.

Working up volumes

Change the field measurements to board-foot volume at home. The board-foot contents of a tree of given diameter and height are given in table 5, 6, or 7. If more than one tree of the same species is the same diameter and height class, multiply the volume figure for one tree by the total number of trees tallied in that space. In fact, for convenience it may be advisable to change the dots and dashes of the field tally to numbers. You can then readily see how many there are in each group and what the multiplier will be. On the sample tally sheet this change has been made.

FIGURE 8. WHITE PINE — DIAMETER BREAST HIGH, 16 INCHES

The project-record sheet calls not for the field tally in the timber estimating but for the total number of trees in each diameter class and the board-foot volume in each diameter class by species. These can easily be transferred after determining the volumes from the field tally sheet.

PART III

LAYING OUT AN ACRE IN THE WOODLOT

So far in this project you have learned how to scale logs and to estimate the board-foot contents of individual standing trees. It is important, however, for you to be able to estimate the timber of the entire woodlots as well.

To give practical experience in doing this work on an area basis, lay out a square or rectangular acre in a woodlot.

TABLE 5. BOARD-FOOT VOLUME FOR SECOND-GROWTH WHITE PINE*

Diameter breast high (inches)	Total height of tree (feet)									
	30	40	50	60	70	80	90	100	110	120
	Volume (board feet)									
5	8	12	15	...	...	...	...	...	...	...
6	13	20	23	27	29	...	...	...	...	...
7	18	28	34	39	44	...	...	...	...	...
8	24	36	45	53	62	...	...	...	...	...
9	32	44	56	69	81	93	...	...	...	...
10	41	53	70	85	102	119	138	...	...	...
11	...	63	84	103	126	147	168	...	...	...
12	...	73	100	125	151	177	200	228	245	...
13	...	84	117	148	180	210	238	270	293	...
14	...	95	137	173	210	243	277	312	348	...
15	...	105	158	200	241	282	321	362	406	...
16	...	...	181	230	277	323	370	415	470	...
17	...	...	209	261	313	368	421	471	540	...
18	...	...	238	297	352	411	475	531	610	688
19	...	...	270	336	393	460	530	598	682	763
20	...	...	302	379	436	506	583	660	750	840
21	...	...	...	425	480	553	634	720	820	918
22	...	...	...	...	522	597	681	779	887	990
23	...	...	...	...	566	639	727	834	958	1,065
24	...	...	...	...	...	674	769	889	1,030	1,135
25	...	...	...	...	...	706	809	942	1,105	...
26	...	...	...	...	...	737	846	994	1,180	...
27	...	...	...	...	...	...	...	1,046	...	...

Stump height 1.3 or less; average top diameter, 5 inches inside bark. Mill cut, 60 per cent round-edged number; 70 per cent 1¼-inch boards, 30 per cent 2½-inch plank.

*Reprinted from **Volume Tables for the Important Timber Trees of the United States. Part 11—Eastern Conifers**, page 25. Compiled by E. N. Munns and R. M. Brown. Forest Service, U.S. Agr. Dept. 1925.

TABLE 6. BOARD-FOOT VOLUME TABLE FOR HEMLOCK*

Diameter breast high (inches)	Total height of tree (feet)							
	30	40	50	60	70	80	90	100
	Volume (board feet)							
6	7	8	8	14	15	...	...	...
7	10	17	19	27	28	...	...	...
8	14	23	32	36	46	49	...	...
9	24	30	41	50	59	68	...	...
10	30	36	50	65	76	84	99	...
11	38	43	65	84	101	115	135	...
12	46	66	85	103	124	145	167	187
13	..	85	109	133	154	181	207	235
14	..	99	128	162	182	213	246	276
15	..	115	150	187	221	255	291	327
16	..	133	174	216	256	293	339	373
17	..	154	198	244	282	336	383	427
18	..	170	226	278	332	379	539	489
19	..	...	254	308	369	427	485	544
20	..	...	284	350	419	479	547	612
21	..	...	309	391	457	533	602	678
22	..	...	340	425	503	570	673	744
23	..	...	380	466	559	636	728	820
24	..	...	413	501	603	689	792	884
25	..	...	439	559	655	763	865	966
26	..	...	...	...	714	828	942	1,054
27	..	...	...	...	...	...	1,023	1,146
28	..	...	...	...	...	...	1,113	1,246
29	..	...	...	...	...	...	1,182	1,336
30	..	...	...	...	...	...	1,277	1,435

*Reprinted from **Hemlock: Its Place in the Silviculture of the Southern New England Forest.** By Perry H. Merrill and Ralph C. Hawley. Yale University, School of Forestry. Bul. 12:28. 1924.

TABLE 7 BOARD-FOOT VOLUME TABLE FOR MIXED HARDWOODS*

Diameter breast high (inches)	Total height of tree (feet)						
	40	50	60	70	80	90	100
	Volume (board feet)						
8	20	20	25	30	...	...	...
9	25	35	40	45	55	...	...
10	35	45	55	65	75	...	...
11	45	60	75	85	100	...	...
12	55	70	90	105	120	...	...
13	..	90	110	130	150	170	...
14	..	105	130	155	180	205	...
15	..	125	155	185	215	245	...
16	..	145	180	215	250	285	...
17	..	...	210	250	290	335	...
18	..	...	240	290	335	380	...
19	..	...	275	325	380	435	...
20	..	...	305	365	430	490	...
21	..	...	340	410	480	550	...
22	..	...	...	460	535	605	...
23	..	...	...	505	590	675	...
24	..	...	...	555	660	745	...
25	..	...	...	...	710	815	920
26	..	...	...	...	770	885	1,005
27	..	...	...	...	...	965	1,090
28	..	...	...	...	...	1,040	1,175

*Reprinted from **Studies of Connecticut Hardwoods.** By Ralph C. Hawley and Rogers G. Wheaton. Yale University, School of Forestry. Bul. 17:35. 1926.

TALLY SHEET FOR ESTIMATING

Date ..... Woodlot ..... Area tallied .....

Tallied by ..... Owner's name .....

Diameter breast high (inches)	Hard maple				Soft maple				Elm				Basswood				White ash				Miscellaneous			
	Height (feet)																							
	40	50	60	70	50	60	70	80	50	60	70	80	40	50	60	70	40	50	60	70	40	50	60	70
8					•1																			
9																								
10		•• 2			1 5																			
11			•1		•1	•1																		
12																								
13																								
14														•• 3										
15			•• 2												•1									
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Making a lining-out device

To measure an acre, in either a square or a rectangle, requires some special equipment, which can be made at home or in the shop. Most important is a lining-out device with which right-angles can be laid out.

For this instrument the following materials are needed:

Two pieces of hardwood (basswood is good) 3 x ¾ x 36 inches
Four finishing nails, 3 inches long, and 4 one-inch long
Carpenter's square
One-inch bit (or auger) and brace
Hammer, saw, and chisel
A piece of seasoned wood 1½ inches in diameter by 4½ feet (a dead sapling of beech, birch, or maple will serve)

To make the lining-out device:

1. Plane and sandpaper the two pieces of hardwood to make the two arms (figure 9).
2. With the carpenter's square, mark the center of each piece.
3. With the square, mark off two lines on each arm, each line 1½ inches from the center, and at right angles to the long sides.

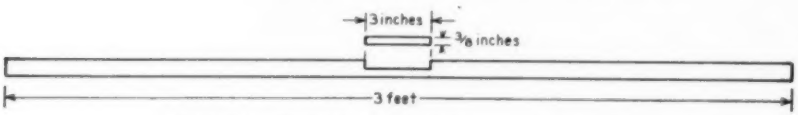

FIGURE 9. SIDE VIEW OF ARM OF LINING-OUT DEVICE

4. Mark off a depth of ⅜ inches on each side from each of the above lines.
5. Join these depth lines with a line (figure 9).
6. With a saw cut down even with the side lines.
7. Take out the wood between the saw cuts with a chisel, making a level joint.
8. Repeat this operation on the other arm.
9. Since the two arms are now ready to be matched, join them exactly at right angles (figure 10).
10. Drive in four small finishing nails in such a way that they will not interfere with a 1-inch hole to be bored in the center.
11. Mark off lines *AB* and *CD* (figure 10) with the square, through the exact center of each arm.
12. Where these lines join, carefully bore a hole with the 1-inch bit or auger.
13. At ½ inch from each end of each arm, drive in a 3-inch finishing nail. These must be exactly straight and on the center line.

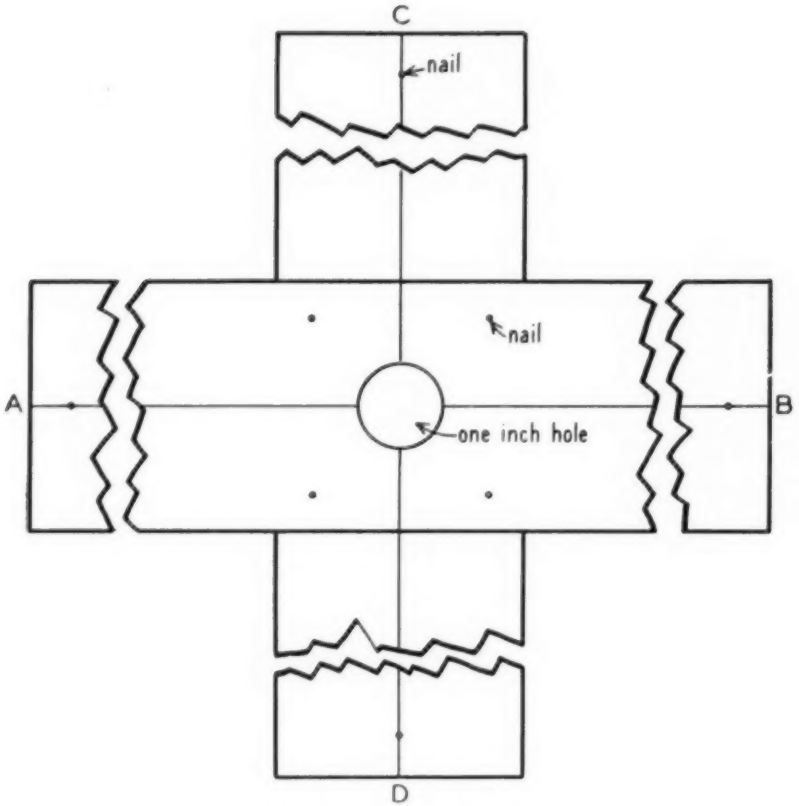

FIGURE 10. TOP VIEW OF LINING-OUT DEVICE

14. Taper the top of the staff (or piece of 1½-inch lumber), starting 6 inches from the end, until it will fit snugly in the hole.
15. Point the lower end of the staff, and, if one is handy, fit it with the shank of an old hoe or shovel which can be pounded to a point.
16. If any of the staff sticks out above the hole, saw it off level with the arms.

Laying out the plot

With the lining-out device for making rectangles, the estimator is ready to proceed to the woods to lay out the plot. In addition to the instrument just made, a 50-foot tape is needed, a hand axe, and four pieces of white cloth to mark the corners. Four stakes are needed to use as corners, but

you can probably cut these in the woods, so it is not necessary to take them from the house.

The project calls for laying out a square or rectangular acre, so it is necessary to have the dimensions in mind. An acre contains 43,560 square feet. By extracting the square root of this number it is found that a square acre has sides approximately 209 feet long. It figures almost 208.72 feet. It may be more convenient to lay out a rectangular acre; that is, an acre with one side longer than the other, so additional data are needed. An acre may be expressed in the rod unit (16½ feet) as well as the foot unit; 160 square rods equal one acre. Dimensions for rectangular acre plots other than those indicated in table 8 might be given, but the length is too long for the width.

TABLE 8. DIMENSIONS FOR SIDES OF RECTANGULAR AND SQUARE ACRES EXPRESSED IN FEET OR RODS

Shape	Feet	Rods
Rectangular	132 by 330	8 by 20
Rectangular	165 by 264	10 by 16
Rectangular	198 by 220	12 by $13\frac{1}{3}$
Square	208.72 by 208.72	$12\frac{2}{3}$ by $12\frac{2}{3}$ (approximate)

With these dimensions in mind in the woodlot, the first corner of the acre plot is established in what looks like average conditions. This corner should be at least 50 feet from the edge of the woodlot and no portion of the plot should touch the edge of the woodlot. In selecting the plot remember also that the majority of the trees in the area should be more than 10 inches in diameter. Establish the first corner by thrusting the staff of the lining-out device into the ground. Set the top in place over the tapered end, with the cross-arms level. By sighting across the two nails on one arm, you can see whether there is a clear lane for the distance of one side of the plot. Your line of sight may be obstructed by a large tree trunk; if so, a twist of the staff to left or right will easily remedy this difficulty. A look in the right-angle direction should be taken to see that the line of sight is clear that way too. Moving the staff either forward or backward a foot or so is usually enough to establish a clear path without blocking the first line of sight.

While the actual work of laying out the plot can be done by one person, it is a slow process, especially when using a 50-foot tape to lay out a side more than 200 feet long, so it is suggested that the family or another club member be called on for assistance.

FIGURE 11. SETTING UP THE LINING-OUT DEVICE

Once the first corner is located, with open sights along lines *AB* and *AC* (figure 12), the other corners are determined as follows:

1. Send the helper about 200 feet along line *AB* with one of stakes to which has been fastened a flag.
2. Have him stick the stake into the ground.
3. Measure the proper distance with the tape and move the stake to corner *B*.

4. Sight along the nails (sights) of the lining-out device and have the partner move the stake until it is exactly in line.
5. Mark with blazes (or with paint) on the side facing the line *AB* all trees outside of and within 5 feet of this line.
6. Lay out line *AC* in the same manner, using the other arm of the lining-out instrument for sighting.
7. Pull up the staff at *A* and replace exactly in the same hole with a stake and flag.
8. Move the staff and instrument to point *C*.
9. Replace that stake and flag with the staff.
10. Level the cross-arms and then twist them to the right or the left until the flag at A is in line with one pair of sights.
11. Sight across the other arm to locate line *CD*.
12. Locate corner *D* in the same manner as corners *B* and *C*.

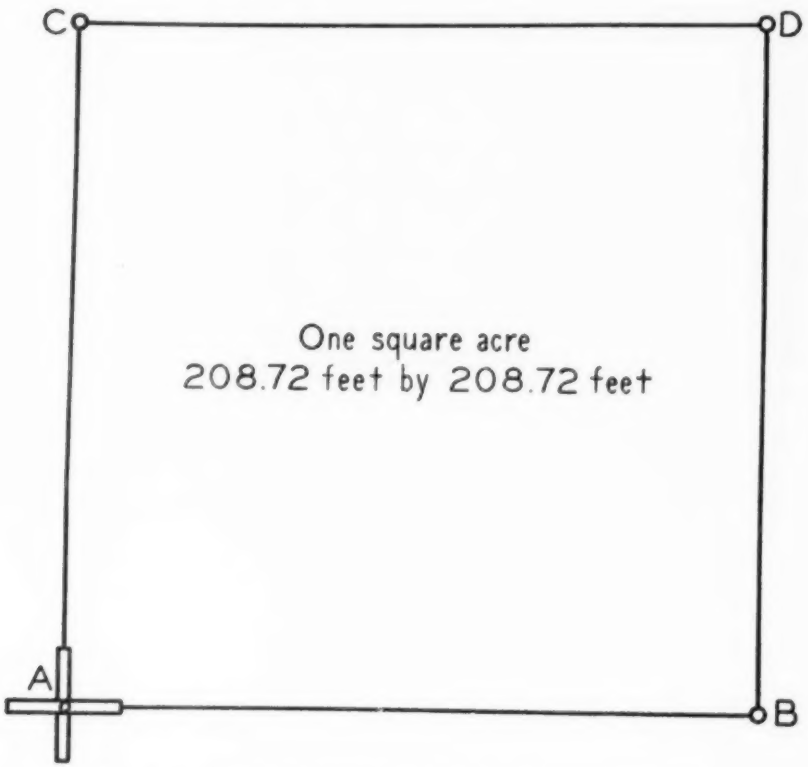

FIGURE 12. SKETCH OF METHOD OF LAYING OUT SQUARE-ACRE PLOT

13. Move the staff to *D* and sight back on *C*.
14. Corner *B* should then be exactly in line with the other arm.
15. Measure the distance from *D* to *B*; it should check within 5 feet for distance and line.
16. If the lines fail to close by more than 10 feet, it is advisable to go back check all distances and angles.

FIGURE 13. "MOVE YOUR FLAG JUST A WEE BIT TO MY RIGHT"

With all four lines located, and the outside border trees blazed or better, marked with paint, on the side *facing* the nearest line, the plot can easily be found at any time.

Cautions:

1. Make sure that the cross-arms are not moved between the sights on adjoining lines (that is, *AB* and *AC*, or *CA* and *CD*).
2. Stretch tape fairly tight when measuring.
3. Set the stakes with flags straight, not leaning.
4. Make light blazes on the trees.
5. It is much easier to lay out the plot on fairly level land.
6. The illustration (figure 12) is for a square plot; follow the same directions for a rectangular plot.

PART IV

TALLYING THE TIMBER ON THE ACRE PLOT

THE final step in completing the timber-estimating project is to measure all the trees 10 inches in diameter breast high and over, on the acre plot.

In preparation for this work, you need a height measurer (hypsometer) as described on pages 12 to 14, and a diameter tape (page 17). Instructions for preparing the tally sheet, are given on page 20, and Part III (pages 22 to 33) describes in detail how to lay out the acre plot.

A piece of carpenter's chalk is needed to mark the trees as soon as they are measured. There will then be little chance of missing any trees or measuring the same ones twice.

The procedure is as follows:

Start in one corner, and work toward the other side of the plot in a fairly narrow strip, and then back on another narrow strip; be sure to mark all the trees with the chalk on the same side, regardless of the direction travelled.

It is not necessary to measure the height of every tree on the acre, though of course, every diameter must be measured. Measure the heights of the first ten trees on the plot. This will indicate the general heights of trees in your woodlot. By comparison you will be able to estimate the height in 10-foot classes of the trees in the immediate vicinity of those measured. When one-fourth way through the plot, stop and take a few more heights to check your judgment, and again when half way through. Whenever there is any doubt about the height of a particular tree, stop and measure it.

It is helpful to have some assistance in measuring the trees just as it was in laying out the plot. When taking heights the helper can hold the

tape while 50 or 100 feet are measured, as the case may be. The helper also can keep the record on the tally sheet as height and diameter and species of the individual trees are called to him.

Record the field information as described in Part II (pages 10 to 22), using the volume tables (pages 23, 24, and 25) and copying the results on the project-record sheet.

Estimating the timber in a whole woodlot

While foresters have developed methods for taking "samples," or a certain percentage of a forested area to save time in timber estimating, it is best in New York woodlots to measure all the trees to obtain a fair estimate. The average woodlot is a little more than 20 acres in this State. Some however, are only 5 acres, while others are many times that size.

To estimate the timber on a good-sized tract, it is best to divide the area into strips. These dividing lines can be run as follows:

1. With string. Fasten the cord to small saplings and limbs every 30 or 40 feet to keep it off the ground. These strips should be not more than 100 feet wide.

2. With paint. A pail of old paint, softened and thinned with turpentine or kerosene, serves well for making spots on the trees. Make these spots along the line, and on opposite sides of the trees, so that they can be seen from more than one point.

In totaling the tally sheets on a whole woodlot, or on part of a woodlot, it is a good idea to find the number of board feet or "stand" per acre. This is obtained by dividing the number of board feet of hemlocks, hard maple, beech, basswood, and so on, separately, by the number of acres in the woodlot. Woodlot areas can be found by measuring the length and width, and dividing by 43,560 (for square feet) or by 160 (for square rods). Pictures taken for the Agricultural Conservation Program show woodlots in detail and from them the acreage can be measured.

Marketing timber

Timber is sold by three methods:

1. Selling by the lot. In this system the buyer makes an offer for the whole woodlot, without the land, and takes whatever he wants. The result is a "skinned" woodlot. The buyer makes a guess, and a low one to be sure, on the amount and value of the timber. Since most woodlot owners do not know how many board feet are standing and fail to realize the value of the different trees, the owner sells "a pig in a poke." Often he gets less than half the value of his timber.

FIGURE 14. A 4-H TIMBER ESTIMATING CREW

2. Selling to a diameter limit. This is a better method than selling by the lot, for the owner controls the cutting to some extent, and keeps his young, fast-growing trees. The owner, however, usually fails to obtain anywhere near the true value of the trees he does sell.

3. Selling by log measure. This is the best method, particularly if the owner marks the trees he wants to sell. The seller receives nearer to true value for his timber. If the seller wants to use Scribner or International log rules, it may pay in the long run to take a slightly smaller price per thousand board feet (per M) and know just what has been sold.

Instead of selling all logs to one buyer or mill, it usually pays to look around for specialized markets. Several outlets for good logs are discussed in Cornell Extension Bulletin 722, *Trees and Products of Farm Woodlots*.

Since this project was outlined to scale logs and to estimate standing timber, you are now in a position to help your father, your neighbor, and yourself (when you own a woodlot now or later). If you wish to sell enough timber to obtain a certain sum of money, you can find from your tally sheets how much timber you have more than 16, 18, or 20 inches in

diameter which could be sold, and at the same time, perhaps, help the growth of the smaller trees in the woodlot.

If a buyer wants to buy the whole woodlot, you can compare the value of the trees with the amount offered. You will not be selling with your eyes closed.

If the owner and the hired man can cut, buck, skid, and haul the logs, even to the roadside, you will be getting paid for their labor in addition to the stumpage value of the timber. Winter woods-work comes at a time when there is often little to do besides chores, so time otherwise wasted is put to good use. Some sellers have nearly doubled the income from their logs by doing their own cutting.

RECORDS

A 4-H Club member should keep records of the work accomplished as part of this project. The yellow project record sheet in the center of this bulletin is to be filled out and sent to the club agent by October 1. In addition to the achievement pin, you will receive the satisfaction for work well done and of additional knowledge gained.

OTHER 4-H FORESTRY PROJECTS

To meet the demand for hardwood seedlings for planting, another project, called the *Hardwood Nursery Project*, is available. In this a Club member collects, stores, and plants enough seeds to grow 1000 or more hardwood seedlings. These can be sold or planted on the club member's own land. Information on this project should be obtained in the fall from the club agent so that the seeds may be gathered in time. A companion project deals with planting the hardwood seedlings grown at home into a field no longer needed for crop land or pasture.

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